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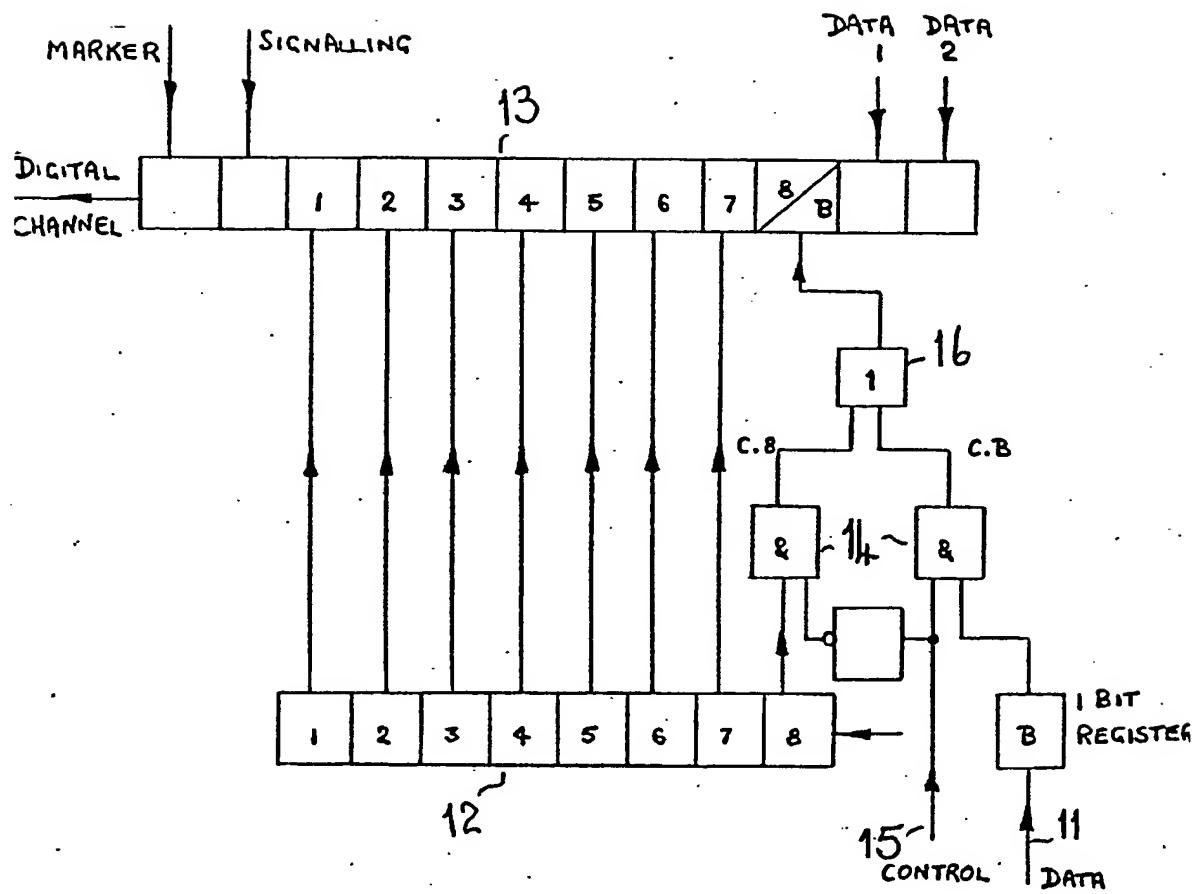
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(54) Telecommunication systems

(57) In a telecommunication system in which speech signals are sampled and the sample values digitally encoded for transmission, there are provided means selectively to replace the least significant digits of a sequence of coded samples by a sequence of data digits, whereby the data digits may be transmitted with the encoded speech signals.

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SPECIFICATION
Telecommunication systems

The present invention relates to a transmission of
 5 data over a digital speech transmission path.

In a telecommunication system in which speech is
 coded in digital form for transmission within the
 system, it is a relatively simple matter to multiplex
 other digital signals such as data signals with the
 10 coded speech signals to provide a number of
 services within the system either related to or
 independent of the speech channels. Typical ser-
 vices would include viewdata, teletext, facsimile,
 metering and alarms. Provision may also be made
 15 for signals controlling the transmission network and
 for directing the various services to the correct
 destinations.

One area in which such speech and data multiplex-
 ing would be particularly useful is the subscribers'
 20 network, that is the part of the transmission system
 between an exchange and its subscribers, since it
 would enable a subscriber to use data services while
 holding a normal telephone conversation.

The multiplexing can be achieved by replacing the
 25 least significant bit of every eight-bit coded speech
 sample by a data or a signalling bit, a technique
 known as "bit-stealing", which allows the data or
 signalling information to be transmitted with the
 coded speech at the expense of speech quality.
 30 Generally the reduction in quality is not significant
 subjectively, but on circuits where distortion is
 present, acceptable standards of speech quality may
 not be attained.

According to the present invention in a telecom-
 35 munications system in which each of a succession of
 samples of a speech signal to be transmitted over
 the system is digitally encoded for transmission
 there are provided means selectively to replace a
 40 digit of a coded speech sample by a data digit
 whereby data signals may be transmitted with said
 speech signals.

Preferably said means operates in dependence
 upon the value of a control signal to replace the least
 significant digit of a coded speech sample by a data
 45 digit. The means may comprise two registers be-
 tween which the digits of a coded speech sample
 may be transferred in parallel selectively with or
 without the replacement of the least significant digit,
 which may be effected by gating means between the
 50 respective stages of the two registers.

A telecommunications system in accordance with
 the present invention will now be described by way
 of example with reference to the accompanying
 drawing, which shows part of the system schematic-
 55 ally.

- In the telecommunication system, which may
 include a conventional telephone system, speech
 signals to be transmitted over at least some of the
 transmission paths of the system are sampled
 60 periodically and the amplitude of each sample is
 digitally encoded for transmission, for example in
 eight-bit compression law format. At any point in the
 transmission path of the encoded samples there
 may be provided an arrangement as shown in the
 65 drawing, by means of which digital data signals at an

input 11 may be multiplexed with encoded speech
 signals for transmission with those speech signals.

The arrangement comprises a register 12 into
 which the eight bits of an encoded sample may be
 70 entered serially and from which these bits may be
 transferred in parallel to another register 13.

The least significant bit of the encoded sample is
 transferred by way of one of a pair of AND gates 14
 one or other of which is enabled by means of a
 75 control signal from an input 15, or its inverse, to pass
 the least significant bit or a data bit to an OR gate 16.
 The least significant bit stage of the register 13
 thereby receives either a speech bit or a data bit, and
 in the latter case successive eight-bit bytes repre-
 80 senting successive encoded samples may carry a
 predetermined succession of data bits forming a
 header or framing code to enable the receiving end
 and demultiplexer to detect that data bits and not
 speech bits are present.

85 The eight bits from the register 13 may be read out
 serially, preceded by a marker bit and a signalling
 bit, and followed by one or more data bits which
 may subsequently be routed separately from the
 eight bits of the multiplexed sample.

90 When no data is present the full encoded speech
 sample is transmitted. In practice, even when data is
 present, in many instances the ratio of simultaneous
 data to simultaneous speech is very low, so that full
 95 speech standards are maintained for a very high
 percentage of the time. This situation arises because
 of the following points:

- 1) digital speech bit rates are much higher than
 many data services so that the ratio of data/
 speech bits is low,
- 100 2) natural breaks occur in speaking,
- 3) for many subscriber services, the transmitted
 data is only intermittent,
- 4) breaks in both speaking and data transmission
 occur to allow reception from the other end and
 105 these breaks would generally be unsynchro-
 nised.

CLAIMS

110 1. A telecommunications system in which each
 of a succession of samples of a speech signal to be
 transmitted over the system is digitally encoded for
 transmission wherein there are provided means
 115 selectively to replace a digit of a coded speech
 sample by a data digit whereby data signals may be
 transmitted with said speech signals.

2. A telecommunications system in accordance
 with Claim 1 wherein said means operates in
 dependence upon the value of a control signal to
 120 replace the least significant digit of a coded speech
 sample by a data digit.

3. A telecommunication system in accordance
 with Claim 1 or Claim 2 wherein said means
 comprises two registers between which the digits of
 125 a coded speech sample are arranged to be trans-
 ferred in parallel selectively with or without the replace-
 ment of the least significant digit.

4. A telecommunication system in accordance
 with Claim 3 wherein the selective replacement of
 130 the least significant digit is effected by gating means

between the respective stages of the two registers.

5. A telecommunication system substantially as hereinbefore described with reference to the accompanying drawing.

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